UNIVERSITI TEKNOLOGI MARA

EMBEDDED HARDWARE IMPLEMENTATION FOR REAL TIME HAND GESTURE RECOGNITION

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Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Electrical Engineering

July 2017

CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 20th August 2017 to conduct the final examination of Farah Farhana binti Mod Ma'asum on her Master of Science thesis entitled "Embedded Hardware Implementation for Real-Time Hand Gesture Recognition" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners recommends that the student be awarded the relevant degree. The panel of Examiners was as follows:

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

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ABSTRACT

This research is focused in designing a low-cost embedded system which can produce robust marker-less tracking system. The application will benefit medical, disabled person and factories, since it can perform as a replacement of mouse cursor by just gesturing motion in the air. The performance of the hand gesture image recognition, segmentation technique and feature classification technique is established as part of the processes. There are four main phases were set up in achieving the research objectives. Initially, image of hand which are being captured are being segmented using Canny and Otsu threshold technique. Then, the hand image is extracted using convex hull and convexity technique while angle of fingertips is obtained from feature vector representation. Three actions are classified: MOVE, RIGHT CLICK and LEFT CLICK cursor. All these actions are then demonstrated with the Arduino board to verify that all techniques are authenticated based on the signal sent by hand gesture. An experiment is set up for 10 users for validation. Also, the users are trained to familiarize with the gesture system. The results revealed that the users are better trained in controlling their fingertips after five-minute of training in the second trial. The findings show that an increase in the LEFT CLICK action is achieved from 33.3% to 52.6%. The RIGHT CLICK is improved from 46.7% to 61% while 56.7% to 77.3 % for MOVE cursor. The results indicate that the system is capable to replace the multi-touch modalities. In addition, there are three different LED colors: RED, YELLOW and BLACK are embedded to the system to represent the gesture - MOVE, RIGHT CLICK and LEFT CLICK respectively, using serial communication. For that reason, low-cost embedded system for marker-less tracking system has been verified to obtain good gesture recognition.

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